

**PROFILE OF
BROOKHAVEN NATIONAL LABORATORY (BNL)**

May 1996

Office of Oversight
Environment, Safety and Health
U.S. Department of Energy

FOREWORD

Site profiles provide senior Office of Environment, Safety and Health managers with relevant and current site environment, safety, and health performance information as well as communicating to Department of Energy line management the Office of Oversight's concerns and understanding of site conditions. Site profiles are a key management tool used by the Office of Oversight to focus and prioritize independent oversight evaluation activities and to optimize the allocation of Oversight resources. The Office of Oversight maintains site profiles on 20 major Department of Energy sites, and normally updates each profile semiannually through a process of soliciting Department of Energy line management review and comment on the revised site profile information. Upon resolution of any line management comments, the profile is considered validated and is disseminated.

Site profiles are developed using an institutionalized process of collecting data from multiple sources, and then collating, synthesizing, and analyzing this information to develop a balanced evaluation of environment, safety, and health performance at the site. The data that forms the basis of a site profile comes from sources both internal and external to the Department of Energy. Office of Oversight appraisal activities provide an important source of data. Data is also collected and synthesized from such sources as the Defense Nuclear Facilities Safety Board, the General Accounting Office, state regulators, and Department of Energy line management organizations. This information is reported in a format designed to highlight essential missions, performance, significant issues, and operational data at a management level. The process involves additional field verification of initial conclusions to confirm the validity and significance of the information. All Oversight offices participate in the collection, analysis, interpretation, and validation of site profile information.

As the site profile process matures, the Office of Oversight plans to incorporate additional information into the documents including a presentation of quantitative measures and trends in environment, safety, and health performance, and a description of safeguards and security activities, performance, and issues.

PROFILE OF BROOKHAVEN NATIONAL LABORATORY (BNL)

OVERVIEW

SITE CHARACTERISTICS

Site characteristics include information on site size and location, mission, organizations, contractual status, and major initiatives and activities.

Date Established: 1947

Present Mission:

To support the basic Department of Energy (DOE) activities by providing specialized research facilities that could not be designed built and operated at a university or industrial complex.

Scientific Research: Carry out basic and applied scientific research in long-term, high-risk programs.

Technology Development: Develop advanced technologies that address national needs, support and strengthen the ability of DOE to carry out its missions, support other Federal and state agencies, and enable industry to benefit from the multi-disciplinary research and development at the laboratory.

Knowledge Transfer: Disseminate scientific and technical knowledge to educate new generations of scientists and engineers, to produce a technically trained work force, and to enhance the scientific literacy of the general public.

Size: 5,300 acres

Employees: Approximately 3,500 DOE and contractor personnel (as of March 1996)

Annual Budget: \$485 million for fiscal year 1996.

Cognizant Secretarial Office: The Director of the Office of Energy Research (ER)--principal ER offices are the Office of Basic Energy Sciences (ER-10), the Office of High Energy and Nuclear Physics (ER-20), and the Office of Health and Environmental Research (ER-70). The Director of the Office of Nuclear Energy, the Director of the Office of Environmental Management, and the Director of Office of Science Education and Technical Information also have programmatic interests on site.

Additional information on site characteristics is provided in Section 1.0, starting on page 1.

BNL continues its primary mission to support the basic Department of Energy activities by providing specialized research facilities

Responsible Operations/Area Office: Chicago Operations Office (CH)/Brookhaven Group (BHG).

Contractors: Associated Universities, Inc (AUI), a not-for-profit corporation chartered under the State of New York. AUI founding institutions include Columbia University, Cornell University, Harvard University, The Johns Hopkins University, Princeton University, University of Pennsylvania, Yale University, and University of Rochester.

Major Subcontractors: (These contractors have obligations equal to or greater than \$3M)

CDM Federal Programs: Environmental restoration activities
Conroy Contracting: Basic ordering agreement
IT Corporation - Environmental restoration activities
J. Kokolakis Contracting: Construction.

Fissile Material: Fresh reactor fuel elements are stored in a fuel vault. Spent fuel is stored in a spent fuel pool pending shipment to the Savannah River Site. Total fresh and exposed fuel is approximately 235 kg in the form of highly enriched uranium. Fissile material other than reactor fuels consists of less than 0.1 kg of U-235, U-233, Pu-238, Pu-239, and others for experiments.

Significant Commitments to Stake holders: Interagency Agreement with the U.S. Department of Energy, Environmental Protection Agency, and the New York State Department of Environmental Conservation which outlines the framework for site characterization and cleanup of laboratory remediation sites. A memorandum of understanding has also been in effect between BNL and the County of Suffolk which outlines a commitment by the Laboratory to comply with the technical standards established by in Suffolk County Sanitary Codes specifically related to the specifications for storage tanks and other storage areas for chemicals. There is an agreement with local interests and residents to monitor and remedy contamination of the ground water aquifer, and to convert potentially affected residential well users to the municipal water supply. No Defense Nuclear Facilities Safety Board (DNFSB) recommendations directly affect BNL. BNL does not include any defense facilities.

Unions:

- International Brotherhood of Electrical Workers, Local 2230.

- Long Island Guard Union, Local 37, International Guard Union of America.
- Oil, Chemical, and Atomic Workers International Union, AFL-CIO Local 8-431.

Major Site Activities/Initiatives:

Substantial modification to the existing Alternating Gradient Synchrotron (AGS) facility.

A Proton Radiation Therapy facility for treating x-ray resistant human cancers, and a Deep Ultraviolet Free-Electron Laser User facility at the National Synchrotron Light Source (NSLS).

Improvement to the Final Safety Analysis Report (FSAR) for High Flux Beam Reactor (HFBR), and the Medical Research Reactor (MRR).

The site characterization and cleanup framework for Environmental Restoration.

Completion of the Hazardous Waste Management Facility (HWMF)

Construction of the Relativistic Heavy Ion Collider (RHIC), an accelerator complex, is under way. The RHIC is expected to be operational in 1999.

Additional information on major activities and initiatives is provided in Section 1.4 starting on page 2.

ENVIRONMENT, SAFETY, AND HEALTH (ES&H) ISSUES

A sitewide issue is an issue present at multiple facilities or within ES&H programs that impact sitewide operations.

Sitewide Issue 1: Ground Water Aquifer Contamination. Previous organic chemical soil contamination at some BNL facilities has migrated into the aquifer that serves as a sole source of water for many Suffolk County residents. Continued, expedited characterization and remediation of this contamination, which is currently passing the site boundary, is necessary to protect health and limit liability.

Sitewide Issue 2: ES&H Program Changes and Improvements . Overall Departmental line management and Laboratory administration and direction of the ES&H program at BNL is in a period of transition as these organizations respond to changes in: (1) the nature of the BNL operating contract, (2) CH and BHG ES&H roles and responsibilities, and (3) Departmental ES&H requirements.

Sitewide Issue 3: Reactor Fuel. Spent fuel storage at HFBR will be at capacity in 18 to 24 months unless provisions for shipping spent fuel to an offsite recipient emerge.

Additional information on sitewide issues is provided in Section 3.0, starting on page 8.

KEY FACILITIES

A key facility is a facility or building that is significant from an environment, safety, and health perspective. At some sites, a key facility can be a group of facilities with similar missions, activities, hazard or vulnerabilities.

High Flux Beam Reactor (HFBR) - Category A reactor fueled with enriched uranium, and moderated and cooled by heavy water.

Medical Research Reactor (MRR) - Supports the Boron Neutron Capture Therapy (BNCT) Program, which is aimed at the treatment of certain cancers.

Alternating Gradient Synchrotron (AGS) Complex - High-energy physics research; accelerates protons to energies up to 33 GeV and heavy ion beams to 15 GeV.

Hazardous Waste Management Facility (H WMF) - Central receiving facility for processing, neutralizing, and storing of radioactive wastes, Resources Conservation and Recovery Act (RCRA) hazardous wastes, and mixed wastes generated throughout BNL.

National Synchrotron Light Source (NSLS) - Uses a linear accelerator and booster synchrotron as an injection system for two electron storage rings—a 750 MeV vacuum ultraviolet ring for spectroscopy studies and a 2.5 GeV x-ray ring for x-ray diffraction studies.

SITE PERFORMANCE

Site performance is based on an analysis of available data on facilities and programs. This includes information from Office of Oversight activities, augmented by valid and relevant external and internal sources. Site performance is evaluated in terms of three of the guiding principles for safety management.

Overall Safety Management Program - NOT EVALUATED

Principle #1 - Line Management Responsibility - NOT EVALUATED

CH oversight of BNL activities is in a period of transition. The CH Environment, Safety and Health Division (ESHD), which previously performed internal oversight activities, now serves as a resource to BHG, which is responsible for performing line management ESH assessments of laboratory activities.

Additional information on key facilities is provided in Section 4.0, starting on page 10.

Over 800 experimental physicists worldwide are making use of the AGS facilities.

Approximately 2500 visiting scientists Use the NSLS.

Additional information on site performance is provided in Section 2.0, starting on page 4.

BHG renegotiated its contract with AUI for operation of BNL in August 1995. The new contract includes a performance fee based on research quality and laboratory operations, including ES&H. The emergence of overall ES&H and other performance information is not anticipated until after a full year of experience with the new performance measuring metrics.

The Type B investigation by CH and followup by the Office of Environment, Safety and Health (EH) in response to the March 31, 1994, TRISTAN Experiment fire involving a small quantity of enriched U-235 indicated the need for substantial improvement in the planning, conducting, and managing experiments by AUI and BHG, and in the management and oversight provided by higher levels of Departmental line management

Principle #2 - Comprehensive Requirements - NOT EVALUATED

BHG and BNL have identified and prioritized their ES&H risk areas and have identified a series of improvement initiatives designed to address and ameliorate these areas. The initiatives include upgrading safety analysis reports, systematically assessing hazards, establishing a chemical management system, enhancing worker safety, and upgrading the industrial hygiene program.

Principle #3 - Competence of Personnel - NOT EVALUATED

BHG is implementing a program to formally qualify all primary Facility Representatives.

PERFORMANCE MEASURES

Performance measures are quantitative and qualitative indications of ES&H performance taken from such sources as the Occurrence Reporting and Processing System and the Computerized Accident/Incident Reporting System, as well as contractually mandated indicators of performance.

To be provided in future versions of the site profile.

Additional information on performance measures will be provided in Section 5.0 of future versions of the site profile.

Figure 1. BNL Site Map

SITE PROFILE – BROOKHAVEN NATIONAL LABORATORY (BNL)

1.0 SITE CHARACTERISTICS

1.1 SITE LOCATION AND SIZE

Brookhaven National Laboratory (BNL) occupies 5,300 acres of flat land in Suffolk County in Long Island, New York.

1.2 SITE MISSION

This multi-program laboratory was established in 1947. The current mission is to support implementation of the Department of Energy's scientific and technical role as described in the National Energy Strategy.

In support of the scientific and technical mission, the laboratory operates two small nuclear reactors for experiments and medical diagnostic and treatment purposes. It also operates, upgrades, and constructs national particle research accelerator facilities for high-energy nuclear physics, chemistry, biology and materials research. Experiments are predominantly designed and conducted by university and industry users under the management and oversight of the laboratory.

The design and construction of improved facilities for the collection, treatment, and ultimate disposition of hazardous waste will support effective remediation of laboratory facilities and sites containing hazardous materials.

Other programs dedicated to education in physical and environmental sciences for all grade levels, technology transfer initiatives for advancing the national technology base, and production and distribution of medical isotopes are examples of initiatives also supported by the laboratory. The scope of the educational programs is currently at risk as a result of funding shortfalls.

1.3 SITE ORGANIZATIONS AND CONTRACT STATUS

Site Organizations

BNL contractor activities are managed by the Department of Energy (DOE) Brookhaven Group (BHG), as directed by the Chicago Operations Office (CH). The Cognizant Secretarial Office is the Director of the Office of Energy Research (ER). The Director of the Office of Environmental Management (EM), the Director of the Office of Nuclear Energy (NE), and the Director of the Office of Science Education and Technical Information (ET) also have programmatic interests in the areas of decontamination and decommissioning (D&D) and environmental restoration, nuclear and reactor facilities, and educational and informational programs, respectively. The prime contractor for Laboratory operations is the Associated Universities, Inc. (AUI).

Major subcontractors (those with obligations of \$3M or more) include:

- CDM Federal Programs - Environmental restoration activities
- Conroy Contracting - Basic ordering agreement
- IT Corporation - Environmental restoration activities
- J. Kokolakis Contracting - Construction.

The laboratory has a full-time staff of approximately 3,500 employees (about 1,250 scientists and engineers, 550 administrative staff, 900 technical staff, and 800 support staff). In addition, the site supports an annual resident population of 1,500 individuals predominantly involved as short-term experimenters, project collaborators, consultants, users, and students.

Site operations and direct support functions currently occupy 354 buildings with a total floor space of about 3,850,000 square feet.

BNL PROFILE

There are numerous residential facilities for experimenters, visiting collaborators and scientists, and other site users.

Contract Status

In August 1995, the Department extended and revised its contract with AUI through September 30, 1996 (Contract Modification NO. M310, Contract No. DE-AC02 76CH00016). A new contract has been written and is undergoing review. The new contract includes a performance fee based on research quality and laboratory operations including environment, safety, and health (ES&H).

1.4 MAJOR SITE INITIATIVES/ACTIVITIES S Programmatic Activities

Substantial modification to the existing Alternating Gradient Synchrotron (AGS) facility are under way in support of the new Relativistic Heavy Ion Collider (RHIC) facility. Most existing functions of the AGS complex will continue, and the facility will serve as the beam source for RHIC (see "Construction Activities" below for additional information on RHIC).

New initiatives include a Proton Radiation Therapy facility for treating x-ray resistant human cancers, and a Deep Ultraviolet Free-Electron Laser User facility at the National Synchrotron Light Source (NSLS).

Physics capability upgrades to the NSLS and HFBR are planned. The improvements are intended to keep these heavily used national research facilities current with user requirements.

A program to replace older components in high-energy accelerators is underway to reduce the ionizing radiation dose to operating and maintenance personnel. Equipment with extensive operating histories is experiencing sufficient beam induced activation of components to require this initiative based on as low as reasonably achievable (ALARA) principles.

OFFICE OF OVERSIGHT

Final Safety Analysis Report (FSAR) improvement initiatives to comply with DOE order requirements are under way for High Flux Beam Reactor (HFBR), and have been proposed to NE for the Medical Research Reactor (MRR).

Environmental Restoration

The characterization and remediation of several remedial sites and facilities is being carried out in concert with other federal and state agencies and local stakeholders.

BNL was placed on the National Priorities List in December 1989. As a result, an Interagency Agreement (IAG) was negotiated and signed in May 1992 by DOE, the U.S. Department of Energy (EPA), and the New York Department of Environmental Conservation (NYSDEC). The IAG sets forth a framework for site characterization and cleanup. Twenty-eight areas of concern have been divided into six operable units and prioritized. Remedial activities are designed and completed as dictated by the results from investigations of specific operable units, with ground water remediation and elimination of potential sources of ground water contamination the focus of restoration activities.

Sources of contamination at Operable Unit I/VI include the Hazardous Waste Management Facility, two inactive landfill areas, glass/chemical/animal disposal pits, two storm water runoff recharge basins, and the Upland Recharge Experimental Area. Sources of contamination at Operable Unit II/VII include the Brookhaven Graphite Research Reactor, the waste concentration facility, the AGS scrap yard, the former Low-Mass Criticality facility, and a particle beam dump. Sources of contamination at Operable Unit III include a building transfer line and underground storage tanks, a bubble chamber area, the cloud chamber group, the old firehouse, the site sewage pipes, the warehouse area, and the former chemistry complex. Sources of contamination at Operable Unit IV include the central steam facility and the reclamation

facility. Sources of contamination at Operable Unit V include the sewage treatment plant, the satellite disposal area, and a portion of the site sewer system. Operable Unit VI is focused on ethylene dibromide (EDB) in the ground water. EDB may have been used as a fumigant in the Biology Field in the 1970s.

Waste Management

The Laboratory currently manages a total burden of 100 tons of industrial waste, 60 tons of hazardous waste, and approximately 15,000 cubic feet of low-level radioactive waste including small quantities of mixed waste resulting from ongoing operations. Limited treatment of waste streams for volume reduction and stabilization is expected to continue.

The Hazardous Waste Management Facility (HWMF) is the principal site for the storage, processing, and packaging of Resource Conservation and Recovery Act (RCRA) hazardous waste and DOE radioactive waste streams. The majority of HWMF buildings were constructed between 1956 and 1966. One building, #483, was constructed in 1986. Completion of a new HWMF is expected during 1996.

The HFBR (reactor) facility undergoes partial core replacement every one to two months. Expended fuel assemblies are stored in the facility's spent fuel pool for short-term decay. After the decay period, the fuel has historically been shipped to the Savannah River Site, as is other foreign and domestic research reactor spent fuel. These shipments are currently postponed pending Departmental resolution of research reactor fuel issues. Interruption of shipments is not expected to interfere with facility operations for between 18 and 24 months. BNL analysis indicates that storage for this period will not result in unanalyzed or otherwise significant health or safety issues.

Construction Activities

Relativistic Heavy Ion Collider. The RHIC, an accelerator complex, is under construction

and is expected to be operational in 1999. Upon completion, the RHIC will be used to explore the nature of nuclear matter under extreme conditions of temperature and density and to search for a new state of matter.

Infrastructure Renovations and Improvements. Funding is being sought for activities characterized by BHG as site rejuvenation. Current funding limitations will not enable any new starts (for improvement of aging or required support facilities) beyond current 1996 commitments.

Science Education Center. The ongoing renovation of an older site building for use as a Science Education Center was interrupted when the structure's truss roof collapsed in January 1996. No injuries resulted. The failure was attributed to a combination of excessive ice and snow loads resulting from abnormally severe winter weather. New plans are proposed to construct a new building that would house the Science Education Center in roughly the same location as the collapsed structure which was removed.

Hazardous Waste Management Facility. Construction completion of the Laboratory's new HWMF is planned for 1996 (see above discussion under "Waste Management").

2.0 SITE PERFORMANCE

2.1 CONCEPTUAL BASIS FOR EVALUATION

The essential characteristic of successful programs and projects is recognizing and understanding the need for an effective management system that ensures adequate control over all aspects of the program or project. In 1994, the Secretary of Energy forwarded to Congress and the Defense Nuclear Facility Safety Board (DNFSB) the principles and criteria that the Department deemed necessary for an effective safety management program. These principles include:

BNL PROFILE

- Principle #1: Line managers are responsible and accountable for safety.
- Principle #2: Comprehensive requirements exist, are executed, and are appropriate.
- Principle #3: Competence is commensurate with responsibilities.

2.2 SAFETY MANAGEMENT PROGRAM IMPLEMENTATION OF THE GUIDING PRINCIPLES

This interim evaluation was developed using information provided to the Office of Oversight by BHG and BNL. This information included the *Brookhaven National Laboratory Institutional Plan FY1996 - FY2001*, October 1995; the *Brookhaven National Laboratory Environmental, Safety, and Health Management Plan Fiscal Years 1996-2001*, March 31, 1995; the *Brookhaven Research Group Business Plan; Full Operations Assessment of the Hazardous Waste Management Facility*, December 18-22, 1995; *Environment, Safety, and Health Assessments of Brookhaven National Laboratory*, October 30 - November 3, 1995; *Multidisciplinary Environment, Safety and Health Appraisal Reports of Brookhaven National Laboratory*, October 17-28, 1994; and a variety of performance indicator information.

Subsequent Office of Oversight surveillances, safety management evaluations, special studies, and reviews will generate additional environment, safety, and health (ES&H) performance information and will provide the opportunity to verify and validate the information presented below. Where sufficient information was not available to make an assessment of either the implementation of a guiding principle (Section 2.2) or an implementing program (Section 2.3), a limited evaluation or specific example of performance based on the best available information is provided.

OFFICE OF OVERSIGHT

Principle #1 - Line Management Responsibility for Safety

CH oversight of BNL activities is in a period of transition. The CH Environment, Safety, and Health Division (ESHD) which previously performed internal oversight activities, now serves as a resource to the BHG, which performs line management ES&H assessments of Laboratory activities. The Nuclear Programs Division of BHG performs daily oversight of reactors at BNL.

BHG renegotiated its contract with AUI for operation of BNL in August 1995. The new contract includes a performance fee based on research quality and laboratory operations including ES&H. Development of overall ES&H performance information is not anticipated until after a year of experience is obtained with the new performance measuring metrics.

In October 1995, CH performed an assessment of BNL lost workday statistics and administration of the workers compensation program. The assessment concluded that BNL experienced a higher lost time incidence rate (i.e., total recordable case incident rates, lost workday incident rates, and lost workday incident rate) than other DOE laboratories and higher rates than a local Long Island employer. It was concluded that this program lacked the necessary formality, documentation, and organizational visibility to allow for effective management of the significant costs associated with occupational injuries.

The Type B investigation by CH and followup by the Office of Environment, Safety and Health (EH) in response to the March 31, 1994, TRISTAN Experiment fire involving a small quantity of enriched U-235 indicated the need for substantial improvement in planning, conducting, and managing experiments by AUI and BHG, and in the management and oversight provided by higher levels of Departmental line management. In response to an Inspector General recommendation, CH conducted an extended root cause analysis in

March 1996. An independent review by the Office of Oversight found that corrective actions at the HFBR had been largely successful in addressing program concerns at the facility level, but the analysis did not fully address DOE line management roles and responsibilities in beam line experiments. Specifically, the root cause analysis did not address the responsibilities of CH, NE and ER for safety performance and their accountability when such performance is absent.

However, in response to the event a number of organizational initiatives were undertaken. BNL completed in-depth reviews of all experiments at HFBR resulting in a number of changes to the ES&H aspects of experimental programs. CH and BHG monitored the BNL Readiness Assessment, developed and conducted the HFBR Restart Readiness Assessment, and monitored the HFBR Restart. CH and BHG also increased oversight of experimental activities performed at HFBR through increased presence of Facility Representatives.

Principle #2 - Comprehensive Requirements

BHG and BNL have identified and prioritized their ES&H risk areas, and have identified a series of initiatives designed to address and ameliorate these risk areas. The initiatives include upgrading safety analysis reports (Sacs), systematically assessing hazards, establishing a chemical management system, enhancing worker safety, and upgrading the industrial hygiene program. (See Section 2.3 for additional information.)

Principle #3 - Competence Commensurate with Responsibilities

BHG is implementing a program to formally qualify all primary Facility Representatives.

2.3 IMPLEMENTING PROGRAMS

Environmental Protection Program

A CH review of the air quality protection program indicated no noncompliance conditions. CH noted that BNL has a comprehensive radionuclide airborne emissions control and monitoring program and is in compliance with EPA standards for Hazardous Air Pollutants (NESHAPS) requirements.

The CH review indicated that BNL has a broad and comprehensive asbestos management program that is in compliance with 40 CFR 61.145 and 40 CFR 61.146. BNL also has a comprehensive program and procedures to comply with EPA regulations for recovery, recycling, and reclaiming of ozone depleting substances. Over 40 operators and supervisors are trained and certified per EPA guidelines on use of recovery units.

The CH review indicated that as part of complying with 40 CFR 68, BNL is developing a risk management plan that (1) addresses the use of propane, (2) includes an assessment of the hazards to the potentially exposed population, and (3) will be registered with EPA.

This review addressed compliance with 40 CFR 70. Specifically, in July 1995 NYSDEC proposed amendments to New York Codes, Rules, and Regulations Part 200, 201, 231 and 621 with respect to implementing Title V of 40 CFR 70. (EPA has not issued its interim or full approval of NYSDEC's proposed permit program.) Facilities that are considered to be major sources of criteria pollutants or hazardous air pollutants or have existing NESHAPS, NSPS, or PSD/NSR sources will be regulated under the Title V Permit Program. BNL is considered one of these facilities. This permit program will consolidate all Federal and state air quality requirements into a single document. NYSDEC has proposed a two-phase transition period for the submittal of operating permit applications. BNL is in the initial stages of developing the Phase I application.

A June 1995 independent technical review of the BNL environmental restoration program

indicated that liability associated with potential offsite contamination of the sole source aquifer was not receiving adequate management and program attention. Eight recommendations were provided, focusing on two areas: (1) use of commercial environmental restoration strategies for addressing DOE's and AUI's greatest liabilities first, and (2) implementation of commercial business processes to improve program execution. This review also outlined a series of enabling, definition, and implementation steps that would support successful transition of the program into an implementation phase of environmental restoration.

Nuclear Safety Program

A cursory review and facility tour related to the preparation of this profile indicated that substantial initiatives are under way to bring the Laboratory's nuclear reactors into conformance with DOE safety requirements and to implement improvement needs identified during follow-up to the Tristram experiment fire at the HFBR.

The HFBR SAR is undergoing re-analysis and upgrade, and a proposal is submitted to NE for the preparation of a SAR for the MRR.

The formality, quality, and availability of safety procedures and their use at HFBR has been improved both for operators and experimenters. Safety equipment upgrades including installation of seismic upgrades and backup nuclear shutdown capability following reactor confinement evacuation, are complete.

Major equipment upgrades at the MRR increase the safety and ease of operations and developing improvements intended to reduce collateral radiation dose to patients are under way.

Worker Safety and Health Program

Three of the major ES&H improvement initiatives involve establishing a chemical management system, enhancing worker safety, and upgrading the industrial hygiene program. The first initiative will develop an overall inventory of existing chemicals and track their usage on a computer-based system. The second initiative is to reduce the frequency and cost of occupational injuries through changes to the safety culture, upgrades to worker and supervisor training, enhanced injury investigation, and improvements in BNL's higher risk work environment. The third initiative is to complete an initial comprehensive baseline industrial hygiene survey and develop necessary implementation plans to address any deficiencies.

A CH ES&H inspection of the BNL industrial hygiene program indicated that (1) policies and requirements have been established in the areas of confined space entry and laser safety, (2) employee training was systematically conducted in these areas, and (3) considerable effort has been expended in the development and implementation of a chemical management system.

A CH assessment of 10 CFR 835 compliance activities indicated that BNL is making a valid attempt to reach full compliance through its development and implementation of a Radiation Protection Plan. BNL is using its Safety and Environmental Protection Division to verify the effectiveness of compliance activities performed by the line organization. This is considered a reasonable approach to conducting internal independent oversight.

A CH evaluation of the experiment safety review (ESR) process indicated that BNL has outlined policy and requirements establishing an appropriate ESR process. When implemented, there should be adequate review of experiments for hazard identification and safety considerations. There has been adequate application of a graded approach in the implementation of the ESR process.

A review of reportable cases (i.e., an occupational fatality, a nonfatal occupational illness, or a nonfatal occupational injury) indicated that for the categories of Total Reportable Cases (TRC), Lost Workday Cases (LWC), and Lost Workdays (LWD) BNL was consistently higher than other DOE laboratories of similar size and function.

The number of occupational safety and health violations open for a period of greater than 90 days at HFBR has shown an increase in the latter half of 1995 from historical totals of between 4 to 6 open violations (July to December 1993 and 1994) to totals of between 9 and 25.

Facility Safety Program

Two of the major ES&H improvement initiatives involve upgrading SACS and systematically assessing hazards. The first initiative is intended to identify facilities that need new or revised safety documentation and/or operational safety limits, and to develop that documentation. This "one-time" effort is intended to comply with significant recent requirements in safety documentation. The second initiative is to perform a formal hazards assessment for BNL, the output of which will provide critical information to the development of upgraded safety analysis reports.

A CH inspection of BNL indicated that there are some discrepancies in fire extinguisher inspection activities. A barcoding system that will provide for computer-generated records of inspection information is to be implemented by August 31, 1996 for those extinguishers in buildings that are inspected monthly and by July 31, 1997 for those extinguishers in buildings that are inspected quarterly.

A CH assessment of the BNL occurrence reporting program indicated that the Laboratory has taken actions to address late completion of final reports and outstanding open corrective actions.

A recent assessment of BHG conduct of operations at HWMF indicated a concern with a large number of posting incidents. The assessment also indicated excellent performance in several areas, including operations organization and administration, communication, investigation of abnormal events, lock/tagout (training), required reading, and operations procedures.

3.0 SITEWIDE ES&H ISSUES

3.1 ISSUE DESCRIPTIONS

Sitewide Issue 1: Ground Water Aquifer Contamination

Previous organic chemical soil contamination at some BNL facilities has migrated into the aquifer that serves as a sole source of water for many Suffolk County residents. Continued expeditious characterization and remediation of this contamination, which is currently passing the site boundary, is necessary to protect health and limit liability. There is an agreement to convert potentially affected individuals from well water supply to the local municipal water system as a precautionary measure to ensure the future quality of water. The situation has resulted in considerable local public interest.

Before mid-1995, environmental restoration program activities at the site had focused on remediating onsite hazards. However, a June 1995 independent technical review of the BNL environmental restoration program indicated that liability associated with potential offsite contamination of the sole source aquifer was not receiving adequate management and program attention. A series of eight recommendations were provided, focusing on two areas: (1) use of commercial environmental restoration strategies for addressing DOE's and AUI's greatest liabilities first, and (2) implementation of commercial business processes to improve program execution (see Section 2.3, Environmental Protection Program, for additional information on the details of this independent review).

In response to this review and the negative public reaction to the contaminated ground water, the environmental program has undergone a strategic redirection. Significant actions taken include the following: (1) BHG and BNL are placing priority on mitigating the liability associated with the offsite contaminated ground water; (2) drinking water is being provided to the residents whose property is underlain by the contaminated ground water; (3) BHG and BNL will be instituting pumping and treating operations at the site boundary to stop further contaminant migration off site and to remove contaminants from the aquifer; (4) more formalized and frequent interactions with stakeholders are occurring; (5) BHG and BNL are adopting a more structured approach to managing environmental restoration activities; and (6) waste minimization activities are being emphasized.

Sitewide Issue 2: ES&H Program Changes and Improvements

Overall Departmental line management and Laboratory administration and direction of the ES&H program at BNL is in a period of transition. Recently, the contract was renegotiated and modified to a performance based contract with an award fee; CH has reorganized its safety staff from being an oversight organization to being a support organization; and considerable changes to Departmental ES&H requirements resulting from DOE order revisions and the emergence of Price Anderson Amendment Act rule making have induced strategic changes to overall ES&H program management.

Implementation of a Performance-Based Contract. In August 1995, DOE renegotiated its contract with AUI for operation of BNL. The contract contains a performance fee based on research and operations (which includes ES&H); this contract will be a principal mechanism for evaluating Laboratory ES&H performance. Institutionalization of this contract will require development of subordinate performance measures for contract administration, enhancements to the

BNL PROFILE

Laboratory self-assessment program, and training for BHG staff on contract provisions. A comprehensive evaluation of overall ES&H performance will likely require a full year or more of experience with the new performance metrics. The challenge for BHG is to continue to provide line management oversight of BNL ES&H programs while the systems necessary for administration of the contract are being developed and implemented.

Redefinition of CH and BHG Roles and Responsibilities. Historically, CH (specifically the ESHD organization) has conducted audits, appraisals, and other assessments of BNL ES&H programs and activities. The BHG Operations and Safety Management Division served in a support role for all audits or appraisals conducted at BNL. CH management has redefined the roles of its ES&H organizations by establishing that the cognizant DOE field element has responsibility for evaluating the effectiveness of the Laboratory line organization in implementing ES&H programs, and that the CH ESHD organization is to serve in a support capacity by providing necessary resources and expertise. The challenge for BHG is to ensure that personnel responsible for evaluating ES&H programs and activities at BNL (including Facility Representatives) implement their roles and responsibilities in a consistent and uniform manner.

Establishment of ES&H Improvement Activities. As part of the Laboratory Institutional Plan, a series of ES&H improvement initiatives have been identified to address significant areas of ES&H risk. These initiatives include: (1) establishing a chemical management system; (2) enhancing worker safety through changes to the safety culture, upgrades to worker and supervisor training, and improvements in BNL's high risk work environment; (3) upgrading the industrial hygiene program; (4) upgrading safety analysis reports; and (5) performing a sitewide hazards assessment. The challenge for BHG and BNL is to ensure that these initiatives are implemented effectively and

OFFICE OF OVERSIGHT

assimilated into the research and development culture of the Laboratory.

Sitewide Issue 3: Management of Spent Fuel

Spent fuel storage at HFBR will be at capacity in 18 to 24 months unless provisions for shipping spent fuel to an offsite recipient emerge. Although this condition does not currently pose any significant ES&H risk, it could, if not remediated, pose serious impacts to HFBR plant operations.

BHG has been given the responsibility for coordinating all activities associated with the planning and conduct of a successful spent nuclear fuel shipping campaign from HFBR to the Savannah River Site including developing comprehensive transportation and communications plans in partnership with BNL, ensuring that all applicable regulatory requirements are incorporated into planning activities, providing guidance and leadership in involving stakeholders, preparing necessary National Environmental Policy Act (NEPA) documentation, providing opportunities for state and local emergency preparedness organizations to train for transportation accidents involving radiological hazards, and supporting negotiations for use of shipping sites if barging of spent fuel is shipped by barge.

However, a number of significant organizational and institutional barriers must be addressed if the shipping campaign is to be conducted effectively. First, there are various local, state, and Federal regulatory requirements that must be considered to support a successful shipping campaign. Second, local public and political opposition to shipping campaigns could at least delay shipping activities. Third, significant coordination with organizations external to DOE is necessary to plan and execute shipping campaigns (e.g., state and local law enforcement, state and local emergency preparedness support, entities with jurisdiction over barge shipping). As of April 1996, a significant amount of coordination with these agencies has been established. Finally, significant coordination with DOE will involve

the Office of Environmental Management, the Office of Nuclear Energy, the Office of Energy Research, the Chicago Operations Office, and the Savannah River Operations Office.

3.2 SITEWIDE ISSUE STATUS

Table 1 characterizes sitewide issues in terms of an issue statement, primary concerns, site activities, and a progress evaluation.

4.0 KEY FACILITIES

4.1 FACILITY MISSION

High Flux Beam Reactor (HFBR)

The HFBR is a Category A reactor located in Building 750. It is fueled with enriched uranium, and moderated and cooled by heavy water. The HFBR achieved criticality in 1965, operating at a routine power level ranging from 40 to 60 megawatts (MW) thermal. However, since May 1991, HFBR has operated at a power level of 30 thermal. Plans to increase reactor power to 60 mw are proceeding.

The area (the 750 complex) also houses a special nuclear material (SNM) vault and a separate HFBR fuel vault. The items stored in the SNM vault have various physical and chemical compositions and may include acidified solutions, metal foils and oxides, salts, alloys, and sealed sources. Typically materials stored consist of uranium and plutonium of various enrichments. Within the HFBR fuel vault, fresh fuel elements are stored in DOE certified shipping containers.

Medical Research Reactor (MRR)

The MRR is an integral part of the Medical Research Center (MRC). The current mission is to support the Boron Neutron Capture Therapy (BNCT) Program, which is aimed at the treatment of certain cancers.

The reactor provides a source of thermal and epithermal neutrons and other radiation for medical research. The reactor is used as a basic research instrument for studies in such fields as medical physics, neutron capture

therapy, radiation damage, nuclear physics, radiation chemistry, and biological effects of radiation. In addition, the reactor is used for isotope production, neutron activation analysis, and training for reactor operators.

An effort has begun to design and build a new shutter for the patient treatment beam port incorporating fission converter plates and a filter for producing an enhanced epithermal neutron beam with much greater epithermal flux and less contamination by gamma rays and fast neutrons. This will permit patients to be treated in only 5 to 10 minutes, instead of 40 to 50 minutes,

Table 1. Sitewide Issues

ISSUE	PRIMARY CONCERNS	SITE ACTIVITIES	PROGRESS EVALUATION
1. Previous organic chemical soil contamination at some BNL facilities has migrated into the aquifer that serves as a sole source of water for many Suffolk County residents. Continued, expeditious characterization and remediation of this contamination, which is currently passing the site boundary, is necessary to protect health and limit liability.	If the contamination is not effectively remediated (e.g., by pumping and treating at the site boundary), public perceptions of site activities will be negatively impacted, and DOE may be exposed to potential liability.	There is an agreement to convert potentially affected individuals from well water supply to the local municipal water system. Offsite and site boundary monitoring wells are being used to assess contaminant levels. Ground water is being pumped and treated at the site boundary for removal of contaminants.	Not evaluated (updated 5/96)
2. Overall Departmental line management and Laboratory administration and direction of the ES&H program at BNL is in a period of transition as these organizations respond to changes in: (1) the nature of the BNL operating contract, (2) CH and BHG ES&H roles and responsibilities, and (3) Departmental ES&H requirements.	BHG must continue to provide effective oversight of Laboratory ES&H programs and activities while the systems and structures that are necessary to implement these initiatives are being developed.	Implement performance-based contract; develop supporting performance measures and restructure self-assessment activities. Qualify Primary Facility Representatives. Modify CH and BHG ES&H roles and responsibilities. Implement ES&H improvement initiatives.	Not evaluated (updated 5/96)
3. Spent fuel storage at HFBR will be at capacity in 18 to 24 months unless provisions for shipping spent fuel to an offsite recipient emerge.	If the spent fuel assemblies are not shipped to the Savannah River Site in a timely manner, the limited capacity of the HFBR spent fuel canal could increase the vulnerabilities associated with prolonged storage of spent fuel.	Ensure that personnel understand regulatory requirements, including shipping requirements. Communications plan has been developed. Support training of local emergency preparedness personnel.	Not evaluated (updated 5/96)

BNL PROFILE

thereby accomplishing major reductions in total radiation dose.

The MRR is fueled with enriched uranium, moderated and cooled by light water, and is operated intermittently at power levels up to 3 MW thermal. A major upgrade of the MRR instrumentation was completed in Fiscal Year 1994.

Alternating Gradient Synchrotron (AGS) Complex

The AGS complex became operational in 1961 and is used for high-energy and nuclear physics research. It accelerates protons to energies up to 33 GeV and heavy ion beams to 15 GeV. Over 800 experimental physicists worldwide are making use of the AGS facilities.

The facility encompasses the AGS experimental halls (Building 912); the 200 MeV Linear Accelerator, or LINAC (Building 930); the AGS Booster Circular Accelerator (Building 914); the Tandem Van de Graaf Generator (Building 901); and the Heavy Ion Transfer Tunnel (Building 909).

The AGS complex underwent major upgrade and expansion in 1969. The AGS Booster increased the AGS intensity by a factor of three from 1985 to 1994.

The 200 MeV LINAC serves as a proton injector for the AGS Booster, and also supplies a continuous beam of protons for radionuclide production by spallation reactions in the Brookhaven Linac Isotope Production Facility (BLIP). The Tandem Van de Graaf Cyclotron is used in medium energy physics investigations, as well as for special nuclide production. The heavy ions from the Tandem Van de Graaf can also be injected into the AGS for use in physics experiments.

Hazardous Waste Management Facility (HWMF)

OFFICE OF OVERSIGHT

The HWMF is the central receiving facility for the processing, neutralizing, and storing of radioactive wastes, RCRA hazardous wastes, and mixed wastes generated throughout BNL. The HWMF is a fenced area of approximately 9 acres located in the southeastern portion of the site. A new HWMF is being constructed, and is expected to be operational in 1996. Between 15 and 40 tons of solvents, waste oils, solids, caustics, ignitable wastes, and various lab chemicals are handled at HWMF annually.

The HWMF includes Buildings 444, 446, 448, 483, 650, 801, 802, and 811.

- Building 444, Old Chemical Building, stores and sorts small containers of nonradioactive hazardous chemical wastes awaiting disposal offsite.
- Building 446, Radioactive Waste Sorting Barn, sorts and compresses compatible radioactive wastes for disposal at Hanford.
- Building 448, Chemical Receipt Back Barn, stores and prepares chemical waste (Labpak waste) for offsite shipment.
- Building 483, Chemical Storage Building stores nonradioactive hazardous wastes and polycarbonated biphenyl (PCB) contaminated oils.
- Building 650, Reclamation Facility, stores low-level radioactive waste and hazardous waste. It is planned to dispose of this waste and ultimately vacate the facility.
- Building 802, Tritiated Water Evaporation Facility, converts slightly tritiated but highly purified water to steam and sends the steam to the HFBR stack for emission.
- Building 811, Waste Concentration Facility, is the central facility for processing radioactive aqueous waste.

National Synchrotron Light Source (NSLS)

The NSLS started operating in 1982 and utilizes a linear accelerator and booster synchrotron as an injection system for two electron storage rings—a 750 MeV vacuum ultraviolet ring for spectroscopy studies and a 2.5 GeV x-ray ring for x-ray diffraction studies. This facility operates 24 hours per day, 7 days per week, and hosts a constant stream of experimenters. The NSLS staff of 220 personnel and approximately 2500 visiting scientists occupy the building.

The NSLS acid cleaning facility in Building 197 is currently being replaced by a new Central Degreasing Facility that will accomplish component cleaning without the use of hazardous materials. for component cleaning; Building 510 for office space; and Building 536 for vacuum/control testing. Two NSLS storage-work facilities (Buildings 726 and 727) were completed in 1982. The NSLS Accelerator Test Facility is housed in Building 820.

4.2 FACILITY SUMMARY

Table 2 summarizes key facility characteristics, including status, hazard classification, authorization basis, worst case design basis accident, and principal hazards and vulnerabilities.

Unless otherwise noted, information on worst case design basis accidents was not available. The data represents an unmitigated event, using the highest risk, highest consequence preliminary hazard analysis scenario.

5.0 PERFORMANCE MEASURES

This section is under development and will be presented in future versions of the site profile.

Table 2. Facility Summary

FACILITY NAME	STATUS	HAZARD CLASSIFICATION/ AUTHORIZATION BASIS	WORST CASE DESIGN BASIS ACCIDENT	PF
---------------	--------	---	-------------------------------------	----

BNL PROFILE
OFFICE OF OVERSIGHT

High Flux Beam Reactor (HFBR)	Operational	Hazard Classification of Category 1. Safety Basis - Has approved SAR and TSR's.	Catastrophic beam tube failure	Hazards: Radioactive waste (HFBR fuel rod ends, sources, targets, experimental devices, contaminated equipment, etc.); mixed and RCRA hazardous waste.
Medical Research Reactor (MRR)	Operational	Hazard Classification of Category 2. Safety Basis - Final Hazard Summary Report, Technical Safety Requirements, and Description of Facilities and Mechanical Components (BNL-600 Manual); SAR implementation plan submitted to DOE Headquarters.	No accident has been identified that would cause fuel damage	Hazards: Argon 41, produced during reactor operations.
Alternating Gradient Synchrotron Complex (AGS)	Operational	Nonnuclear facility; low hazard classification as per DOE Order 5480.25, Safety and Accelerator Facilities; Safety Basis - DOE approved accelerator implementation plan	Radiation accident, fire accident, and hydrogen target accident	Hazards: Particle beam induced external ionizing radiation exposure, flammable and combustible materials, electrical energy, and cryogenic targets
Hazardous Waste Management Facility (HWMF)	Operational; A new HWMF is currently under construction and is expected to be operational in 1996.	Hazard Classification of Category 2. Safety Basis - Basis of Interim Operation for the Hazardous Waste Management Facility, May 22, 1994; Preliminary Hazard Assessment for the Hazardous Waste Management Facility, May 27, 1994	Building 446 - Furnace or electrical short results in fire - worker killed through smoke or chemical inhalation or burns Yard - Inadvertent radiation exposure in excess of 3 rem; worker death from forklift accident; worker death from detonation of explosives	Hazards: Radioactive waste (HFBR fuel rod ends, sources, targets, experimental devices, contaminated equipment, etc.); mixed and RCRA hazardous waste; and PCB-contaminated oils.
National Synchrotron Light Source (NSLS)	Operational	Nonnuclear/radiological facility; low hazard classification as per DOE Order 5480.25, Safety and Accelerator Facilities; Safety Basis - DOE approved accelerator implementation plan	Radiation accident, hydrogen target accident	Hazards: Particle beam induced external ionizing radiation exposure, lasers, electrical energy, cryogenics, and magnetic sources.